Rapid Consequence Estimation with HEC-FIA

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Outline

- Introduction
- Rapid Consequence Assessment Overview
  - Data needs
  - H&H modeling
  - Econ and Loss of Life estimation
- Example

Why Rapid Assessment?

- PRA process for Dams
  - Screening of Dams– existing data, 1 day effort
  - Periodic Assessment – existing data, minimal effort
  - Issue Evaluation – supplement critical data gaps, intermediate level of analysis
  - Risk Reduction Study – detailed data and analysis
- Full analysis is data intensive (H&H, Life Loss)

Rapid Consequence Assessment

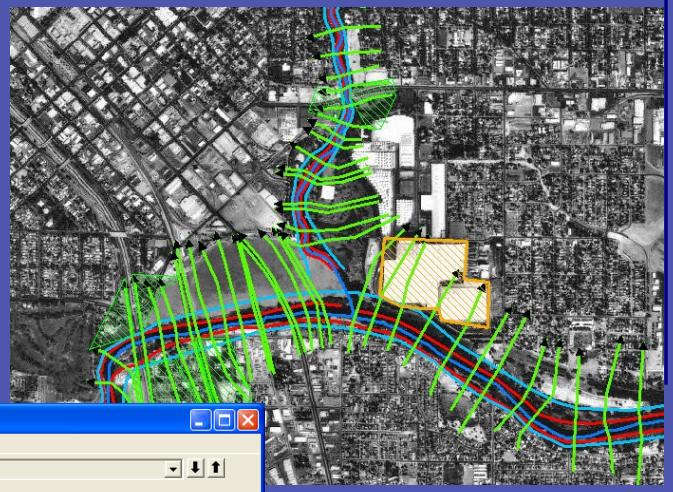
- Method
  - H&H Analysis
    - Use existing model or create new (HEC-RAS)
    - Generate depth grids (HEC-GeoRAS)
  - Consequence Analysis (HEC-FIA)
    - Load/generate structure inventory and depth grids
    - Run events
    - Results – Life loss and economic damage

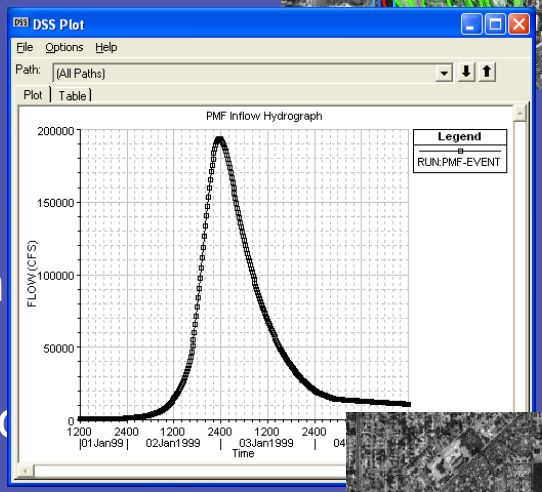
Rapid Consequence Data Needs

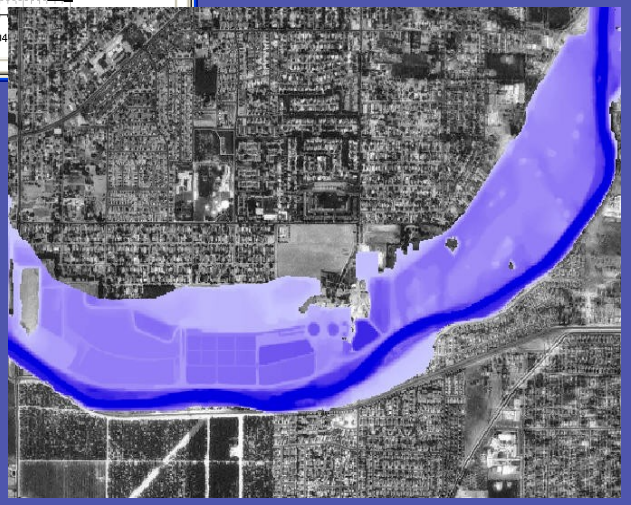
- H&H (if no existing model)
  - Digital Terrain Model (DTM)
  - Aerial photography
  - Hydrography
  - Adjacent dams
  - Event hydrographs
  - Physical Characteristics dam/levee
- Consequence
  - Structure inventory (existing/parcels/HAZUS)
  - DTM/Hydrography/Depth grids/Aerials (from H&H)

H&H Modeling

- HEC-GeoRAS
  - Develop Cross-Sectional Data
  - Develop Storage Areas
  - Import to RAS
- HEC-RAS
  - Load event hydrograph
  - Model failure modes
  - Analyzes river hydraulic
  - Compute water depth, velocity, & inundation boundaries
  - Export RAS to GeoRAS
- HEC-GeoRAS
  - Visualize Floodplain



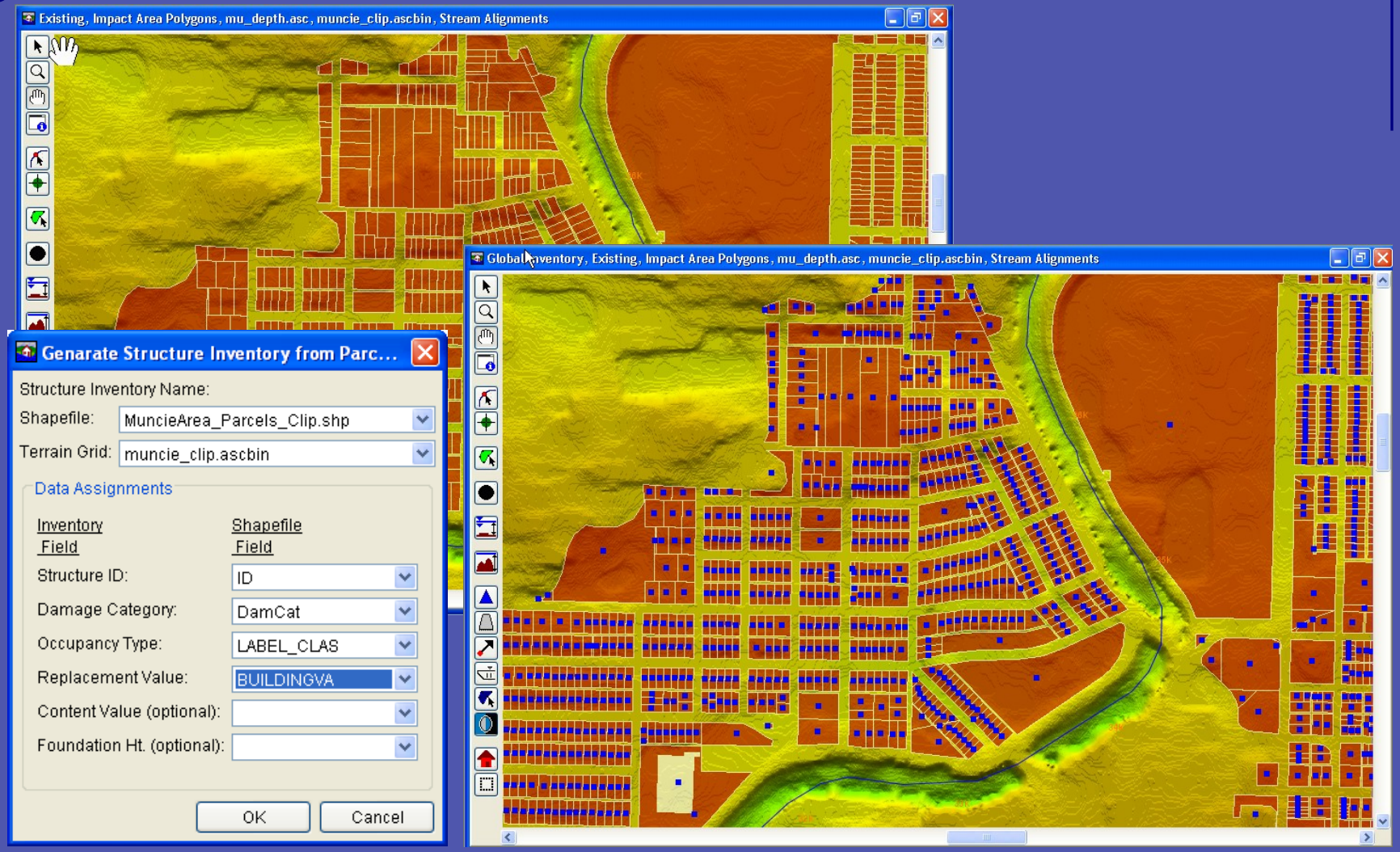




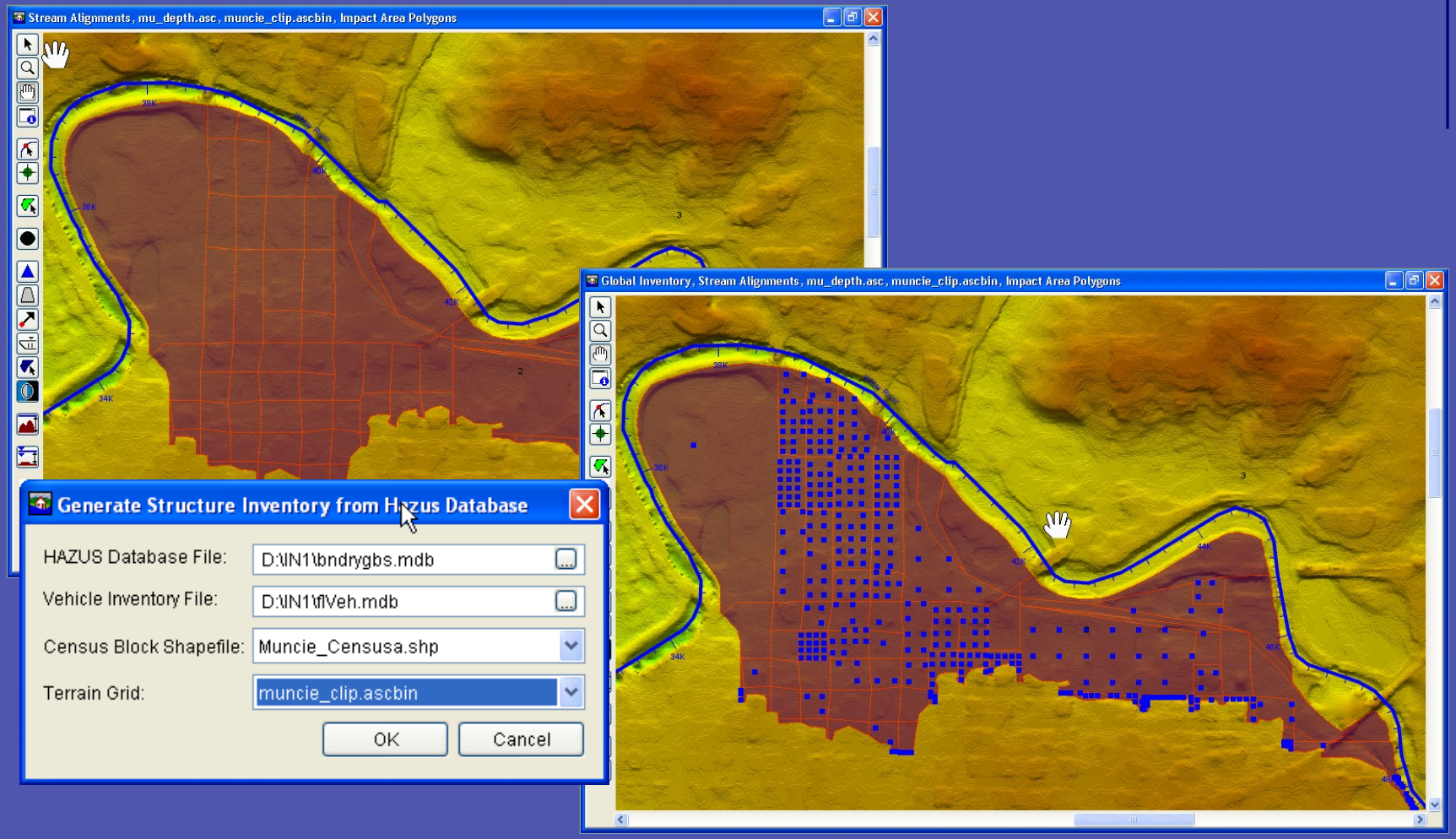
Consequence Modeling with HEC-FIA

- GIS Damage Computations
  - Urban/Agricultural/PAR/Life Loss
  - Individual structure
  - Depth grids
  - Duration-based
- Structure Inventory Creation
  - Parcel
  - HAZUS Data
- Agricultural Inventory
  - Polygon
  - HAZUS Data

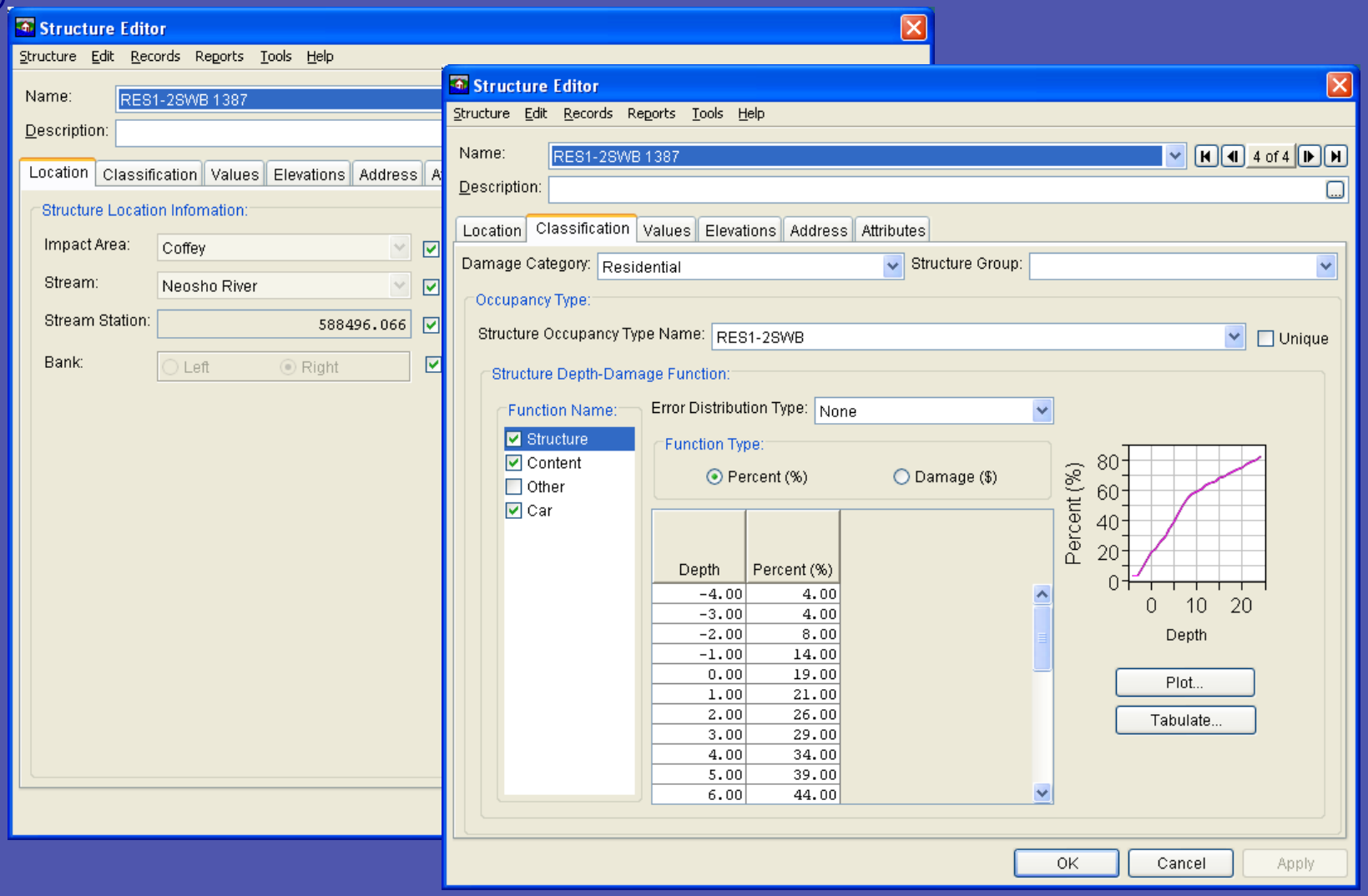
Parcel-based Inventory



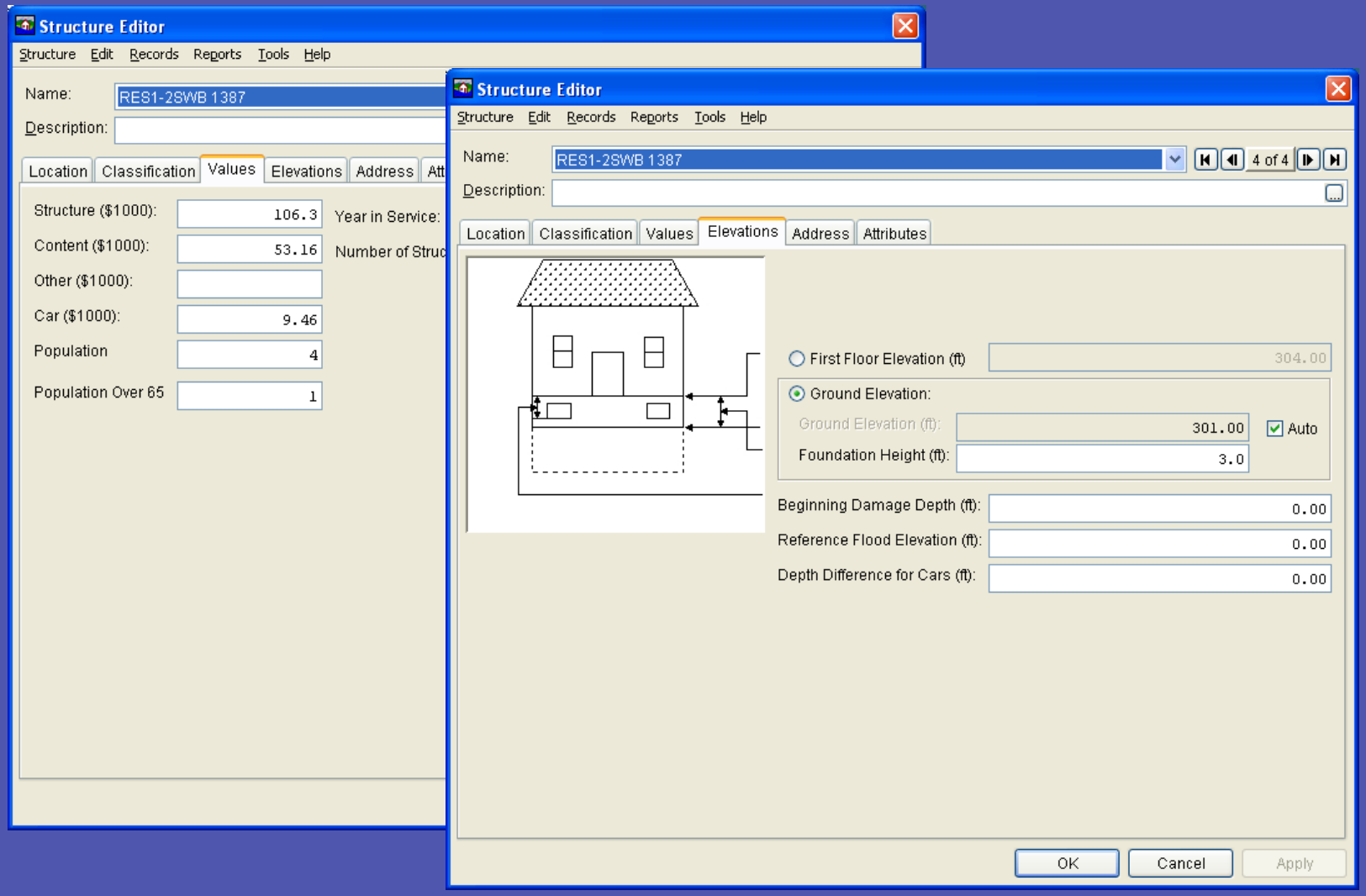
HAZUS-based Inventory



Structure Data



Structure Data



Individual Structure Damage

Agricultural Damage

- GIS method
  - Grid-based
    - Converts agricultural polygon to grid
  - Duration-based
    - Uses time-series of depth grids
- Computation
  - For each grid cell in agriculture grid
    - Seasonal Based Damage = acreage of grid cell * ((crop unit price*yield/acre) – harvest cost/acre) * damage %)
      - % damage = based on date of flooding
    - Final damage = Seasonal based damage * Durational % damage

Population Impacted (PAR)

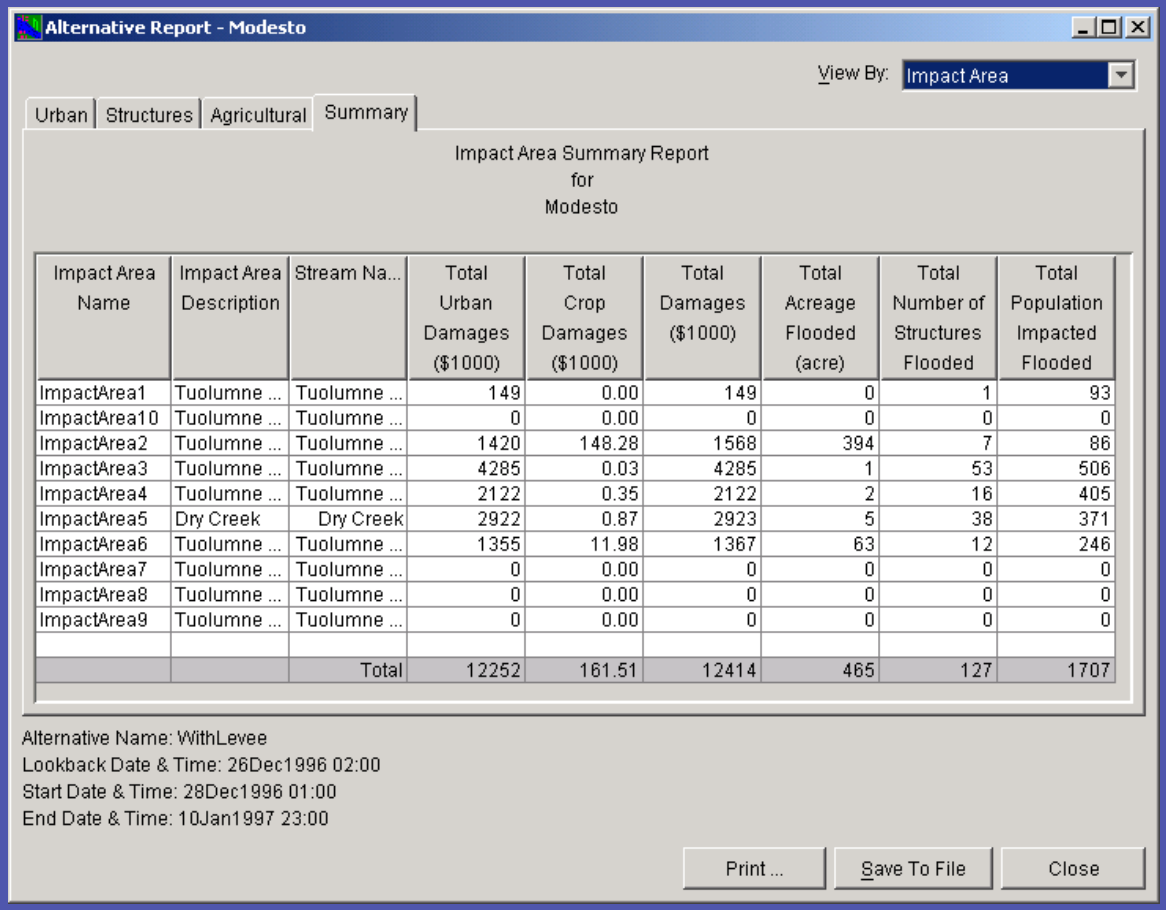
- Census data
  - HAZUS
    - Geodatabase
    - Census block
  - Distributed among structures
    - During HAZUS SI generation
    - For existing inventory
- Reports
  - Population impacted
- Loss of Life being added to HEC-FIA
  - Simplified LifeSim

Simplified LifeSim

- Loss of life factors
  - Flood event
    - Location, geometry, and rate of breach development
    - Water level, time of day, detection time
    - Extent, velocity, depth, and arrival times
  - Number and location of people
    - Initial distribution, effectiveness of warning, response to warning, effectiveness of evacuation, degree of shelter
  - Loss of life among threatened population
    - Empirical fatality-rates based on shelter

HEC-FIA Output

Event Flood Damage Summary

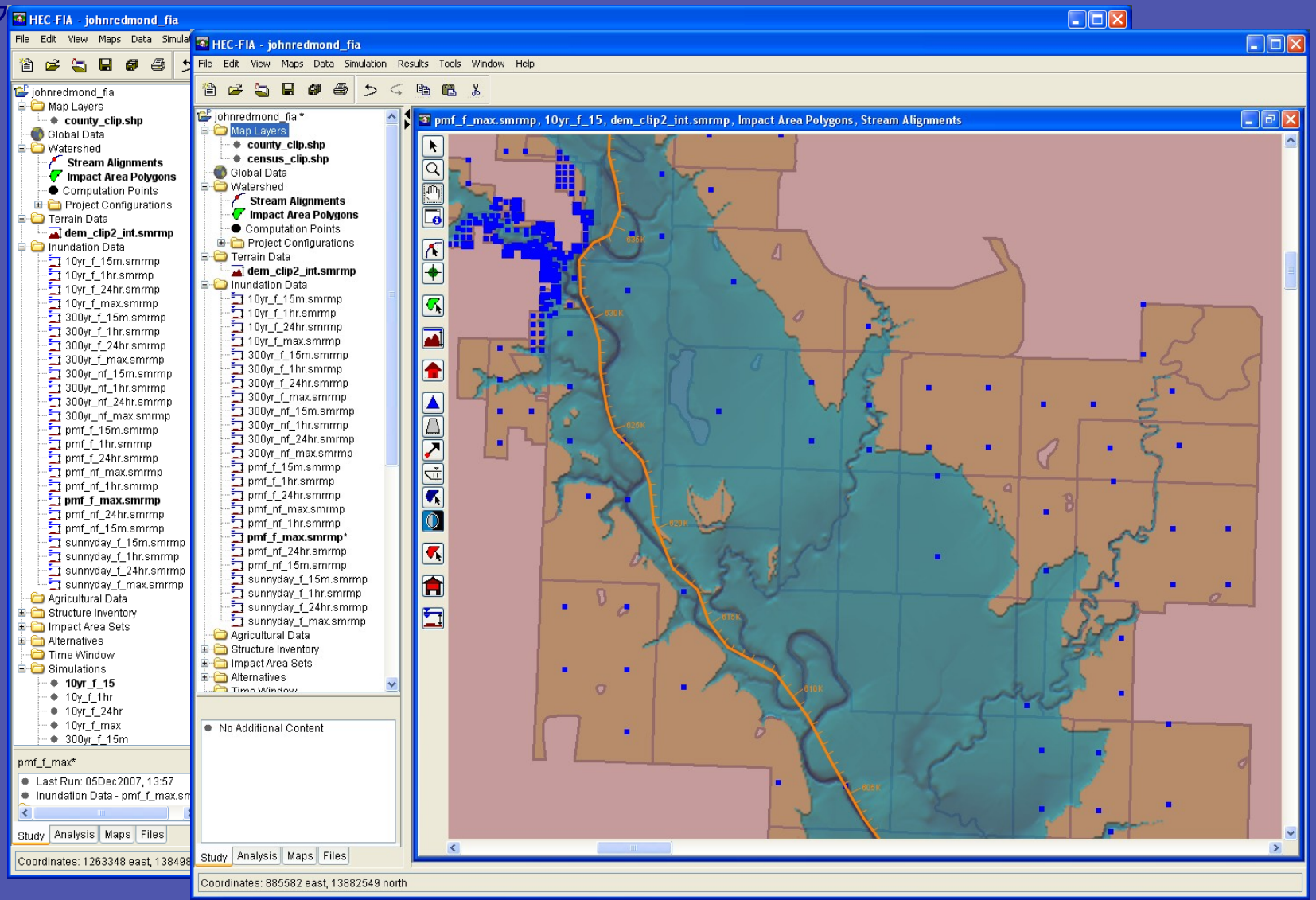


Impact Area Name	Impact Area Description	Stream Na...	Total Urban Damages ($1000)	Total Crop Damages ($1000)	Total Damages ($1000)	Total Acreage Flooded (acre)	Total Number of Structures Flooded	Total Population Impacted Flooded
ImpactArea1	Tuolumne ...	Tuolumne ...	149	0.00	149	0	1	93
ImpactArea10	Tuolumne ...	Tuolumne ...	0	0.00	0	0	0	0
ImpactArea2	Tuolumne ...	Tuolumne ...	1420	148.28	1568	394	7	86
ImpactArea3	Tuolumne ...	Tuolumne ...	4285	0.03	4285	1	53	506
ImpactArea4	Tuolumne ...	Tuolumne ...	2122	0.35	2122	2	16	405
ImpactArea5	Dry Creek	Dry Creek	2922	0.87	2923	5	38	371
ImpactArea6	Tuolumne ...	Tuolumne ...	1355	11.98	1367	63	12	246
ImpactArea7	Tuolumne ...	Tuolumne ...	0	0.00	0	0	0	0
ImpactArea8	Tuolumne ...	Tuolumne ...	0	0.00	0	0	0	0
ImpactArea9	Tuolumne ...	Tuolumne ...	0	0.00	0	0	0	0
		Total	12252	161.51	12414	465	127	1707

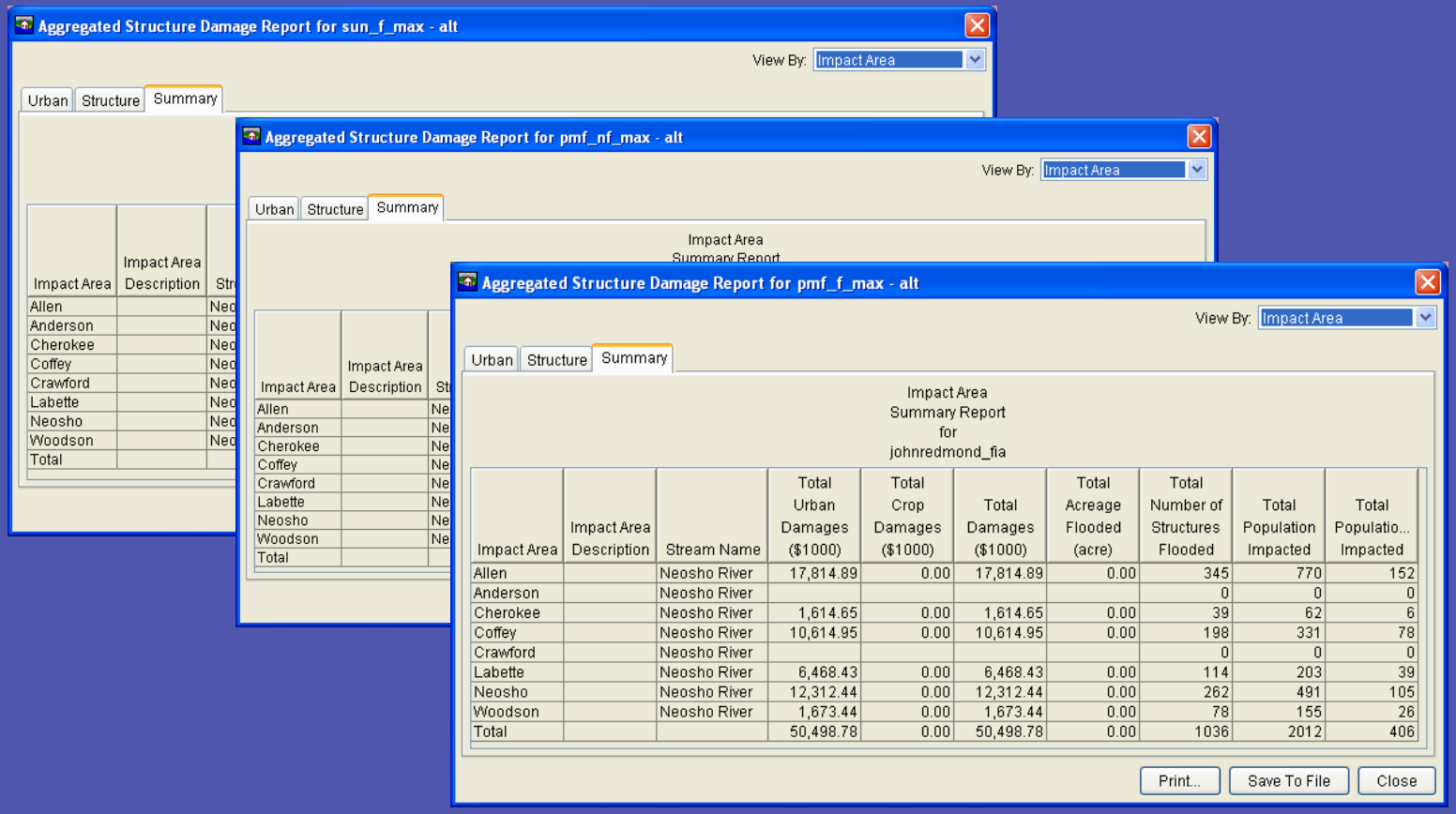
How “Rapid” is Rapid?

- HEC-RAS/GeoRAS
  - Generated using DTM
  - Max depth and hydrographs
  - 2-3 day effort
- HEC-FIA
  - Structure inventory via HAZUS
  - 1 day effort
- Loss of Life
  - 1 day effort

Example – John Redmond Dam



Example – John Redmond Dam


Aggregated Structure Damage Report for sun_f_max - alt
View By: Impact Area
Urban Structure Summary
Impact Area
Impact Area Description
Allen
Anderson
Cherokee
Coffey
Crawford
Labette
Neosho
Woodson
Total
Aggregated Structure Damage Report for pmf_nf_max - alt
View By: Impact Area
Urban Structure Summary
Impact Area
Summary Report
Aggregated Structure Damage Report for pmf_f_max - alt
View By: Impact Area
Urban Structure Summary
Impact Area
Summary Report
for
johnredmond_fia
Impact Area | Impact Area Description | Stream Name | Total Urban Damages ($1000) | Total Crop Damages ($1000) | Total Damages ($1000) | Total Acreage Flooded (acre) | Total Number of Structures Flooded | Total Population Impacted | Total Populatio... Impacted
Allen | | Neosho River | 17,814.89 | 0.00 | 17,814.89 | 0.00 | 345 | 770 | 152
Anderson | | Neosho River | | | | | 0 | 0 | 0
Cherokee | | Neosho River | 1,614.65 | 0.00 | 1,614.65 | 0.00 | 39 | 62 | 6
Coffey | | Neosho River | 10,614.95 | 0.00 | 10,614.95 | 0.00 | 198 | 331 | 78
Crawford | | Neosho River | | | | | 0 | 0 | 0
Labette | | Neosho River | 6,468.43 | 0.00 | 6,468.43 | 0.00 | 114 | 203 | 39
Neosho | | Neosho River | 12,312.44 | 0.00 | 12,312.44 | 0.00 | 262 | 491 | 105
Woodson | | Neosho River | 1,673.44 | 0.00 | 1,673.44 | 0.00 | 78 | 155 | 26
Total | | | 50,498.78 | 0.00 | 50,498.78 | 0.00 | 1036 | 2012 | 406
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